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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A61K 31/19	A1	(11) International Publication Number: WO 97/03663
		(43) International Publication Date: 6 February 1997 (06.02.97)

(21) International Application Number: PCT/NO95/00195

(22) International Filing Date: 25 October 1995 (25.10.95)

(30) Priority Data:
952796 14 July 1995 (14.07.95) NO

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(81) Designated States: AL, AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: NON-β-OXIDIZABLE FATTY ACID ANALOGUES, THEIR USES AS THERAPEUTIC ACTIVE MEDICAMENTS, AND PREPARATION THEREOF

(57) Abstract

There are disclosed compounds of the general formula (I): alkyl-X-CH_2 COOR wherein alkyl represents a saturated or unsaturated hydrocarbon of 8-26 carbon atoms, X represents a sulfur atom or a selenium atom and R is hydrogen or C_1-C_4 alkyl. Said compounds are used for the manufacturing of medicaments for the treatment of hyperlipidemic conditions, (arteriosclerotic disease), coronary artery disease and for reducing the concentration of lipids in blood of mammals, for inhibiting oxidative modification of LDL, and for reducing proliferation of cancer cells. Methods for preparing the compounds are also disclosed.

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NON-β-OXIDIZABLE FATTY ACID ANALOGUES, THEIR USES AS THERAPEUTIC ACTIVE MEDICAMENTS, AND PREPARATION THEREOF.

This invention relates to the use of certain non-β-oxidizable fatty acid analogues for the manufacture of medicaments for the treatment of hypolipidemic conditions, such as for reducing the concentration of cholesterol and triglycerides, and for inhibition of the oxidative modification of low density lipoprotein (LDL) in the blood of mammals. These medicaments also have a preventive effect on growth of tumour cells and may therefore be used in treatment of various terms of cancer diseases. The invention also relates to a method for preparing a medicament based on the mentioned fatty acid analogues, and also relates to a new compound having all of the above given favourable therapeutical effects.

Excess of cholesterol and triglycerides in blood has been shown to accelerate the development of arteriosclerosis and is a risk factor for myocardial infarction. Accordingly, a reduction of excess of lipids in blood by diets or drugs is used as a preventative measure in people at risk due to high levels of cholesterol and triglycerides and high platelet activation.

In this connection reference is made to European Patent Specification No. 345.038 (NORSK HYDRO A.S., priority of GB-8813012 of 2 June 1988) which discloses the use of non-β-oxidizable fatty acid analogues of the general formula (I):

Alkyl-X-CH_2 COOR

wherein alkyl represents a saturated or unsaturated hydrocarbon group of from 8-22 carbon atoms, X represents O, S, SO, and SO_2, and R represents hydrogen or C_1 - C_4 alkyl, for the manufacture of a medicament for the treatment of hyperlipaemic conditions and for reducing the concentration of cholesterol and triglycerides in the blood of mammals. The EP-specification also discloses the preparation of compounds of the actual non-β-oxidizable fatty acid analogues wherein the substituent X represents O, S, SO, SO_2, respectively. The EP-specification reports that the compounds in question exhibit favourable hypolipidemic effects in blood of mammals, such as rats, and possess low toxicity measured as increase in liver weight and increased peroxisomal β-oxidation. The patent concludes that the compounds in question are potentially useful as medicinal compounds. For further considerations we refer to the EP-specification.

It has now been found that the analogues of the above mentioned non-β-oxidizable fatty acid have broader area of applications as an ingredient in drugs than the ones reported in the European Patent Specification No. 0.345.038. Further, it has been found that analogues with other election for the substituent X in the compound of formula (I), exhibit, as will be evident from the below specification, generally more potent pharmaceutical effects, also regarding the previously disclosed teaching of treatment of hypolipidemic conditions for reducing the concentration of cholesterol and triglycerides.
Current research suggests that prevention of atherosclerosis must take into consideration not just lowering plasma cholesterol and triglycerides, but also decreasing the susceptibility of LDL to oxidative damage. Oxidatively modified LDL - but not native LDL - has a number of characteristic properties that may initiate formation of foam cells and promote the development of fatty streaks, the

earliest lesions in atherosclerosis. It could therefore be expected that preventing LDL modification could alternate foam cell formation and the development of plaques.

It is well known that natural long-chain fatty acids, particularly polyunsaturated fatty acids of the main origin, are effective in lowering plasma triglyceride but not cholesterol levels in man. Moreover, as a lipid radical-propagated peroxidation chain reaction, in which the polyunsaturated fatty acids contained in the LDL are rapidly oxidized to lipid hydroperoxides, high supplementation of main based diets rich in ω-3-fatty acids may rather increase LDL oxidation.

The antiatherogenic properties of probucol are supposed to be related to its antioxidant effect rather than to its relatively weak hypocholesterolemic potency.

New strategies have been developed to search for compounds that are likely to protect against radical damage in order to prevent modification of LDL and at the same time be an effective lipid-lowering drug. Considering that polyunsaturated fatty acids are metabolized slowly, we postulated that simple fatty acid analogues blocked for β-oxidation with a reducing agent or atom might result in a very potent compound being able to inhibit LDL oxidative modification and to lower blood lipids.

In feeding experiments with such fatty acid analogues the results show that they lower the blood concentration of cholesterol and triglycerides and inhibit LDL oxidative modification, without any overt toxic effect.

These fatty acids analogues are to the best of our knowledge the simplest lipid and antioxidant compounds found so far.

Considering that there is substantial evidence that polyunsaturated fatty acids from the n-3 family (ω-3 fatty

acids) which are metabolized relatively slowly and reduce proliferation of cancer cells, we postulated that simple non-β-oxidizable fatty acid analogues might have similar effects. Results of in vitro experiments with such fatty acid analogues show that they reduce the rate of proliferation and effect differentiation of cancer cells much more effectively than pure ω-3 fatty acids do.

Thus, the present invention provides fatty acid analogues with the ability a) to lower concentration of cholesterol and triglycerides in the blood, b) to inhibit LDL oxidative modification, and c) to reduce the rate of proliferation of cancer cells. The fatty acid analogues of the present invention provides improved effect relative to ω-3 fatty acids and without undesirable side effects.

More particularly, the present invention relates to the use of non-β-oxidizable fatty acid analogues of the general formula (I)

Alkyl-X-CH_2 COOR

wherein alkyl represents a saturated or unsaturated hydrocarbon group of from 8-26 carbon atoms, X represents a selenium atom, and R is hydrogen or C_1 - C_4 alkyl, for the manufacture of a medicament for

a) the treatment of hyperlipidemic and antiatherogenic conditions, such as for reducing the concentration of cholesterol and triglycerides in the blood of mammals,

b) to inhibit the oxidative modification of low density lipoprotein (LDL),

and

c) to reduce the growth of cancer cells.

In accordance with another aspect of the invention use is made of non-β-oxidizable fatty acid analogues compounds of the above mentioned formula (I) and definitions for Alkyl and R, but wherein the substituent X represents a sulfur

atom, in order to inhibit the oxidative modification of low density lipoprotein (LDL), and to reduce the growth of cancer cells.

Preferably use is made of compounds as defined in the following claims 3-5.

In accordance with a further aspect of the invention therapeutical active medicaments are manufactured in that a compound in question is incorporated in a pharmaceutical acceptable carrier or diluent, as is defined in the following claims 6-8.

In accordance with yet another aspect of the invention the present invention comprises a fatty acid analogue of the general formula (I):

Alkyl-X-CH_2 COOR

wherein Alkyl represents a saturated or unsaturated hydrocarbon group of from 8-22 carbon atoms, X represents a selenium atom and R is hydrogen or C_1 - C_4 alkyl.

Preferably, the fatty acid analogue compound of the general formula (I) is as defined in any of the claims 3-5.

In the preferred embodiment of the present invention "alkyl" represents a tetradecyl group.

The compounds used according to the present invention wherein the substituent **X** is a sulphur atom or a selenium atom may be prepared according to the following general procedures:

X is a sulfur atom:

The thio-substituted compound used according to the present invention may be prepared by the general procedure indicated below:

$$\text{Alkyl-Hal} + \text{HS-CH}_2\text{COOR} \xrightarrow{\text{Base}} \text{Alkyl-S-CH}_2\text{-COOR}$$

The preparation of a number of non-β-oxidizable fatty acid derivates of formula (I) above will now be given by way of illustration.

Example 1.

Synthesis of Tetradecylthioacetic acid $CH_3-(CH_2)_{13}-S-CH_2-COOH$. Compound I.

KOH, 20 g (0,3 equivalents), mercaptoacetic acid, 12 ml (0,14 equivalents), and tetradecyl bromide, 25 ml (0,09 equivalents), were added in that order to 200 ml methanol and the solution was stirred overnight in a nitrogen atmosphere. A white precipitate of potassium bromide was formed. To the reaction mixture concentrated HCl (30 ml) dissolved in water (400 ml) was then added. Tetradecylthioacetic acid started to precipitate immediately and the solution was left overnight at room temperature to complete this process. The product was then isolated by filtration and washed four times with water. After drying the product was crystallized once from diethyl ether and then twice from methanol. Tetradecylthioacetic acid appeared as white flakes with a melting point of 68°C.
Yield: 23 g = 75% as based on the amount of tetradecyl bromide used. ^{1}H-NMR (in $CDCl_3$=:δ 0,84-0,91 (t,3H,CH_3), 1,25-1,45(m,22H, 11 CH_2) 1,60-1,73 (p,2H,-$C\underline{H}_2CH_2S$-), 2,62-2,66 (t,4H, -CH_2S-), 3,24 (s,2H,S-$C\underline{H}_2COOH$), 10,6 (s,1H, COOH).

X is a selenium atom:

The seleno-substituted compound used according to the present invention may be prepared by the following general procedure:

1. Alkyl-Hal + KSeCN ---> Alkyl-SeCN
2. Alkyl-SeCN + BH_4^- ---> Alkyl-Se^-
3. Alkyl-Se^- + O_2 ---> Alkyl-Se-Se-Alkyl

This compound is purified by careful crystallization from ethanol or methanol.

4. Alkyl-Se-Se-Alkyl $\xrightarrow{BH_4^-}$ 2 Alkyl-Se^-
5. Alkyl-Se^- + Hal-CH_2·COOH ---> Alkyl-Se-CG_2-COOH

The final compound, f.ex. when Alkyl is tetradecyl, $CH_3(CH_2)_{13}$-Se-CH_2-COOH, can be purified by crystallization from diethyl ether/hexane. This product may be fully characterized by NMR, IR and molecular weight determination.

In the present case, the selenium compound tetradecylselenoacetic acid of formula $CH_3(CH_2)_{13}$-Se-CH_2-COOH (Compound II) was prepared.

Example 2

Synthesis of tetradecylselenoacetic acid: CH_3-$(CH_2)_{13}$-Se-CH_2-COOH. Compound II.

1. Synthesis of ditetradecyl diselenide: $CH_3(CH_2)_{13}$-Se-Se-$(CH_2)_{13}CH_3$.

Black selenium, 3,54 g (0,045 mol), was suspended in 150 ml 1:1 mixture of tetrahydrofuran (THF) and water in an argon atmosphere. Sodium borohydride ($NaBH_4$), 3,93 g (0,10 mol), in 60 ml of argon-flushed THF:H_2O (1:1) was added dropwise to the suspension (careful, exothermic). A reddish brown colour was initially formed but gradually disappeared. To this solution was added selenium, 3,54 g (0,045 mol),

suspended in 150 ml THF:H_2O (1:1). A reddish-brown solution was formed. The reaction mixture was stirred for 15 min and finally heated for about 10 min to complete the dissolution of selenium. Tetradecyl bromide, 24,9 g (0,09 mol), in THF (50 ml) was then added to the solution. During one hour with gentle heating the solution turned yellow indicating the reaction to be completed. The reaction mixture was treated with chloroform and the organic layer was dried over anhydrous magnesium sulphate, filtered and evaporated to leave a yellow oil solidified upon cooling. Crystallization from diethyl ether gave yellow needles with a melting point of 43°C.
Yield: 20 g = 80% as based on the amount of tetradecyl bromide used.

2. Synthesis of tetradecylselenoacetic acid: $CH_3(CH_2)_{13}$-Se-CH_2COOH. Compound II.
To the diselenide, 1,0 g (0,0018 mol), in 25 ml THF (freshly distilled from benzophenon and sodium) was added dripwise $NaBH_4$, 0,206 g (0,0054 mol), dissolved in 10 ml H_2O in an argon atmosphere. After the solution had been decolorized with bromoacetic acid 1,0 g (0,0072 mol), and triethylamine, 1,0 ml (0,0072 mol), in THF (25 ml) was added and the solution was stirred for 6 h at room temperature. Water (50 ml) was then added and the solution was treated with diethyl ether. The organic layer was discarded. The aqueous layer was acidified with HCl and extracted with diethyl ether. The ether layer was dried over anhydrous magnesium sulphate, filtered and was evaporated in vacuum leaving a white solid.
Crystallizations, one from hexane (30 ml) and then from diethyl ether (30 ml), left white crystals of tetradecylselenoacetic acid with a melting point of 68°C.
Yield: 0,80 g = 66% as based on the amount of ditetradecyl diselenide used.

^{1}H-NMR (in $CDCl_3$): δ 0,84-0,91 (t,3H,CH_3), 1,25-1,45 (m,22H, 11 CH_2), 1,62-1,73 (p, 2H, -$C\underline{H}_2$Se-), 2,8-3,06 (t,4H, -CH_2Se-), 3,15 (s,2H, -Se-$C\underline{H}_2$COOH), 10,6 (s,1H, COOH).

The pharmaceutical effects of the compounds prepared as disclosed above according to the present invention will now be disclosed further in the following experiments which are presented in the tables. The compounds I and II prepared as disclosed above were used in the experiments.

EXPERIMENTS

Hypolipidemic effect

Male wistar rats, weighing 180-200 g at the start of the experiment, were housed individually in metal wire cages in a room maintained at 12 h light-dark cycles and a constant temperature of 20±3 °C. The animals were acclimatized for one week under these conditions before the start of the experiments.

Compound I (tetradecylthioacetic acid), compound II (tetradecylselenoacetic acid) prepared in accordance with Examples 1 and 2, and eicosapentaenoic acid (EPA) were suspended in 0,5% (w/v) carboxymethyl cellulose (CMC). Six animals were used for each treatment and a 0,5% CMC solution was administered to rats as control. After administration of the test compound, rats were fasted for 12 hours and anesthetized with haloethan. Eicosapentaenoic acid and the fatty acid derivatives were administered by gastric intubation (gavage) once daily for 7 days. Blood samples were collected by cardiac puncture, and lipid concentrations in plasma were determined using an autoanalyzer. Results obtained with Se-tetradecylselenoacetic acid (compound II), EPA and tetradecylthioacetic acid (compound I), are reported in Table 1.

Table 1: Effect of compound I, compound II and EPA - hypolipidemic drug on plasma lipid levels in rats.

Compound	Dose mg/day/kg body weight	Decreased Plasma lipids (% of control)	
		triglycerides	cholesterol
Compound II (Se-tetradecyl-selenoacetic acid)	15	25	20
Eicosapenta-enoic acid	1500	20	18
Compound I (Tetradecylthio-acetic acid)	150	45	30

Table 1 shows that tetradecylselenoacetic acid (Compound II) exhibits a good hypolipidemic effect in blood of mammals, such as rats, and posesses low toxicity measured as increase in liver weight and increased peroxisomal β-oxidation (data not shown). It will appear that a 100 times greater dose of the hypolipidemic drug eicosapentaenoic acid is necessary to obtain the same decreased plasma lipid results as obtained for compound II (tetradecylselenoacetic acid). Moreover, the substituted fatty acid compounds are much more effective than pure EPA and fish oil in lowering plasma lipids. Therefore they are potentially useful as medical compounds.

In another set of experiments hepatocytes from rats, not treated with the test compounds, were prepared. Cultured hepatocytes were incubated for 4 hours with [1-^{14}C] palmitic acid (200 μM) in the presence of L-carnitine (0,5 mM) and the different drugs (Table 2) and medium triglycerides (secreted) were extracted and dissolved in n-hexane and separated by thin-layer chromatography on silica plates developed in hexane-diethylether-glacial acetic acid with a ratio of 80:20:1. The bands were visualized by iodine vapor, cut into pieces and counted.

Table 2:
Effect of tetradecylthioacetic acid (compound I), tetradecylselenoacetic acid (compound II), the EPA and oleic acid hypolipidemic drugs (200 µM) on secretion of triglyceride-labeled [1-^{14}C] palmitic acid from hepatocytes incubated with [1-^{14}C] palmic acid (200 µM). Results are given as mean ± SD for values obtained from five independent experiments.

Compound	Secretion of [1-^{14}C] palmitic acid labeled triglycerides (nmol/protein/4 hours)
Compound II tetradecyl-selenoacetic acid	14,4 +/- 6,7**
Eicosapenta-enoic acid	24,4 +/- 10,2*
Compound I Tetradecylthio-acetic acid	18,4 +/- 5,9**
Oleic acid	34,7 +/- 5,96

* $p < 0,05$ compared to oleic acid (control).

** $p < 0,01$ compared control.

Table 2 shows that hepatocytes of rats grown with tetradecylselenoacetic acid and tetradecylthioacetic acid caused a statistically significant lower secretion of palmitic-acid - labeled triglycerides that did oleic acid.

Antioxidant effect

Example 3.

Male wistar rats, weighing 180-200 g at the start of the experiment, were housed individually in metal wire cages in a room maintained at 12 h light-dark cycles and a constant temperature of 20±3°C. The animals were acclimatized for one week under these conditions before the start of the experiments.

Compounds I and II according to the invention, and other fatty acid derivatives, were suspended in 0,5% (w/v) carboxymethyl cellulose (CMC). The fatty acid derivatives were administered by gastric intubation (gavage) once daily for different days. The antioxidant effect as a function of the dose administered was examined.

Six animals were used for each treatment and a 0,5% CMC solution was administered to rats as control. After administration of the test compound, rats were fasted for 12 hours and anesthetized with haloethan. Blood samples were collected by cardiac puncture and LDL preparations were prepared by ultracentrifugation.

In other set of experiments where the acid derivatives were administered at a dose of 250 mg/day/kg body weight, the antioxidant effects of different fatty acid derivatives were compared with that of control. In this experiment the dosing lasted for 7 days. In all these in vivo experiments, adding tetradecylselenoacetic acid (compound II) and tetradecylthioacetic acid (compound I) to plasma as an antioxidant to prevent modification of LDL, in vitro, dramatically increase the lag time (data not shown). Thus the results indicate that compounds I and II achieves a modification of LDL as the lag time increased. Therefore they are potentially useful as medical antioxidants.

Example 4.

Low-density lipoproteins (LDL) were prepared from fresh normal human plasma by sequential ultracentrifugation. LDL were taken as the 1.021 to 1.063 density fraction, dialysed and the oxidation was initiated by addition of $CuSO_4$. The kinetics of LDL oxidation were determined by monitoring the change in absorbence at 234 nm (nano meter) (conjugated dienes). The change in absorbence at 234 nm vs time could be divided into three consecutive phases: lag, propagation and decomposition where the lag time is defined as the interval (minutes) between the intercept of the linear

least-square slope of the curve with the initial-absorbence axis.

Table 3 shows that addition of tetradecylselenoacetic acid (compound II) and tetradecylthioacetic acid (compound I) increased the lag time in a dose-dependent manner of Cu^{2+}-treated LDL. Tetradecylselenoacetic acid (compound II) was much more potent that tetradecylthioacetic acid in the same experimental conditions. Addition of palmitic acid analogues, oxidized 3-thia fatty acid and 3-oxygen substituted fatty acid analogues did not changed the modification of LDL (Table 3).

Table 3. Effect of tetradecylselenoacetic acid (compound II) and tetradecylthioacetic acid (compound I) on modification of LDL from human plasma.

Compound added/concentration	lag Time (min)
No addition (control)	44,1 ± 0,3
Palmitic acid 5 µM	48,2 ± 4,8
10 µM	51,6 ± 4,8
20 µM	50,6 ± 9,6
Tetradecylthioacetic acid (compound I):	
5 µM	58,1 ± 9,6
10 µM	78,5 ± 11,6
20 µM	111,3 ± 23,1

continuation of Table 3.

Tetradecylselenoacetic acid (Compound II):	
1 µM	74,2 ± 6,8*
2 µM	86,9 ± 7,6*
3 µM	152,3 ± 11,5*
Tetradecylsulfonylacetic acid:	
20 µM	48,2 ± 7,1
Tetradecyloxyacetic acid	
20 µM	51,6 ± 6,2

* P < 0,05 compared to control

For such purposes, the compounds of the present invention can be administered orally or parenterally in a conventional dosage or parenterally in a convential dosage form such as tablets, capsules, powders, emulsions and solutions prepared according to conventional pharmaceutical practices.

Reduced proliferation of cancer cell

The effect of tetradecylselenoacetic acid (compound II) and tetradecylthioacetic acid (compound I) on many different cell lines, as specified in the left column of the following table 4, were studied.

Generally, the cells were grown in a humidified (95%) atmosphere of 5 % CO_2 and 95 % O_2 (air) maintained at 37 °C. All experiments were carried out using cell culture plates initially, the cells were plated, i.e. allowed to attach to the bottom, by incubating with plating medium CDulbeccos minimum essential medium.

Each of the test compunds I and II was incubated to each of isolated cell populations in a concentration of 100 µm. Palmitic acid in a concentration of 100 µM was also added to a population as a control sample. The cell number in all

samples was counted six days after the start time of the incubation by using standard techniques.

For the cells of mamma cancer (MCF-7) also Eicosapentaenoic acid and Docahexaenoic acid were tested similarly in concentrations of 100 µM each.

The results are presented in table 4 as the cell number in each sample following six days of incubation in procentage of the control, wherein the palmitic acid (the control) is given as 100 %.

Table 4. Effect of tetradecylselenoacetic acid (compound II), tetradecylthioacetic acid (compound I), and unsaturated fatty acids on cancer cell growth.

Cells	Compounds	Cell number following six days of incubation (% of control)
Brain glioma rat		
BT4C	Palmitic acid	100
	compound II	60
	Tetradecylthioacetic acid	65
BT4CN	Palmitic acid	98
	compound II	70
	Tetradecylthioacetic acid	68
Brain glioma, human		
D-37MG	Palmitic acid	100
	compound II	40
	Tetradecylthioacetic acid	35
D-54MG	Palmitic acid	100
	compound II	55
	Tetradecylthioacetic acid	50
GaMG	Palmitic acid	100
	compound II	60
	Tetradecylthioacetic acid	55

continuation of Table 4.

Leucemic, human			
	HL-60	Palmitic acid	100
		compound II	40
		Tetradecylthioacetic acid	35
	KG1a	Palmitic acid	100
		compound II	60
		Tetradecylthioacetic acid	65
Mamma cancer			
	MCF-7	Palmitic acid	100
		compound II	60
		Tetradecylthioacetic acid	55
		Eicosapentaenoic acid	76
		Docahexaenoic acid	98

The added concentration of the different fatty acids was 100 µM.

For all cell lines each of the compounds I and II exhibits a significant lower value for the count of the cell numbers than do the control compound of palmitic acid. For most of the tested compounds a reduction of proliferation of up to 40% or more was obtained.

As also will appear from table 4, compounds I and II inhibit the proliferation of the cell line of mamma cancer MCF-7 to a greater extent than eicosapentaenoic acid and docahexenoic acid.

The effect of various doses of compound I, compound II, palmitic acid, eicosapentaenoic acid and docahexenoic acid, on the cell number was measured by adding each of said compounds at different concentrations, i.e. at concentrations of 10, 20, 50, 100, and 150 µM, to isolated cell cultures of MCF-7 breast cancer. The number of cancer cells were counted 6 days following incubation by using standard techniques. The results are shown in the following table 5.

Table 5. Effect of tetradecylselenoacetic acid and tetradecylthioacetic acid at different doses on MCF-7 breast cancer cell growth.

Compound	Cell numbers ($x10^3$) in the presence of fatty acids at different concentrations (µM)					
	0	10	20	50	100	150
Palmitic acid	746	658	715	642	710	730
Tetradecylseleno-acetic acid	737	689	590	520	440	420
Tetradecylthio-acetic acid	740	637	570	480	410	400
Eicosapentaenoic acid	630	665	605	520	480	420
Docahexaenoic acid	583	615	626	624	599	610

Table 5 shows that the compounds to various extents effected a reduction in cell number , i.e. a cancer cell prolifation. However, the proliferation was significantly greater for compounds I and II than for the other compounds in the test.

Tables 4 and 5 show that compounds I and II achieved a significant reduction in the rate of proliferation of cancer cells. Therefore the compounds are potentially useful as medicinal compounds.

The compounds used according to the present invention may be administered to patients suffering from any type of dyslipidaemia except type I. As antioxidants they can be used for various cardiovascular diseases. Regarding the reduced proliferation of cancer cells, they may be administered to patients suffering from any type of cancer. Alternatively by dietary they may prevent disease as atherosclerosis and tumor formation.

The dosage range for the compounds according to the present application is contemplated to be from 5 to 100 mg/day for the average adult patient. Of course, the actual dose necessary will depend on the patient's condition and will have to be determined by the attending physician from case-to-case.

For oral pharmaceutical compositions such carrier material as, for example, water, gelatine, gums, lactose, starches, magnesium-stearate, talc, oils, polyalkylene glycol, petroleum jelly and the like may be used. Such pharmaceutical preparation may be in unit dosage form and may additionally contain other therapeutically valuable substances or conventional pharmaceutical adjuvants such as preservatives, stabilizing agents, emulsifiers, buffers and the like. The pharmaceutical preparations may be in conventional solid dosage forms such as tablets, capsules, dragees and the like, in conventional liquid forms such as solutions, suspension, emulsions and the like, and other conventional dosage forms such as dry ampulles, suppositories and the like.

For parenteral administration the compounds according to the present invention may be administered as solutions, suspensions or emulsions using conventional pharmaceutical carrier materials such as for example water for injection, oils, polyalkylene glycols and the like. These pharmaceutical preparations may further include conventional pharmaceutical adjuvants, such as preservatives, stabilizing agents, wetting agents, emulsiers, salts for the adjustment of the osmotic pressure, buffers and the like. The preparations may also contain other therapeutically active materials.

CLAIMS

1. Use of non-β-oxidizable fatty acid analogues of the general formula (I)

Alkyl-X-CH_2 COOR

wherein alkyl represents a saturated or unsaturated hydrocarbon group of from 8-26 carbon atoms, X represents a selenium atom, and R is hydrogen or C_1 - C_4 alkyl, for the manufacture of a medicament:

a) for the treatment of hyperlipidemic and antiatherogenic conditions, such as for reducing the concentration of cholesterol and triglycerides in the blood of mammals,
b) to inhibit the oxidative modification of low density lipoprotein (LDL), and
c) to reduce the growth of cancer cells

2. Use of non-β-oxidizable fatty acid analogues of the general formula (I)

Alkyl-X-CH_2 COOR

wherein alkyl represents a saturated or unsaturated hydrocarbon group of from 8-26 carbon atoms, X represents a sulfur atom, and R is hydrogen or C_1 - C_4 alkyl, for the manufacture of a medicament

a) to inhibit the oxidative modification of low density lipoprotein (LDL), and
b) to reduce the growth of cancer cells.

3. Use according to claim 1 or 2, wherein alkyl represents the tetradecyl group.

4. Use according to claim 2, wherein the compound of formula (I) is tetradecylthioacetic acid.

5. Use according to any of claims 1 - 3, wherein the compound of formula (I) is tetradecylselenoacetic acid.

6. A process for the manufacture of a medicament for a) treatment of hypolipaemic conditions and for reducing the concentration of cholesterol and triglycerides in the blood of mammals, b) to inhibit the oxidative modification of low density lipoprotein (LDL), and c) to reduce the growth of cancer cells,

comprising incorporating with a pharmaceutical acceptable carrier or diluent, a non-β-oxidizable fatty acid analogue of the general formula (I):

Alkyl-X-CH_2 COOR

wherein Alkyl represents a saturated or unsaturated hydrocarbon group of from 8-22 carbon atoms, X represents a selenium atom and R is hydrogen of C_1 - C_4 alkyl.

7. A process for the manufacture of a medicament to inhibit the oxidative modification of low density lipoprotein (LDL), and to reduce the growth of cancer cells,

comprising incorporating with a pharmaceutical acceptable carrier or diluent, a non-β-oxidizable fatty acid analogue of the general formula (I):

Alkyl-X-CH_2 COOR

wherein Alkyl represents a saturated or unsaturated hydrocarbon group of from 8-22 carbon atoms, X represents a sulfur atom and R is hydrogen or C_1 - C_4 alkyl.

8. A process according to Claim 6 or 7, wherein the compound of general formula (I) is as defined in any of Claims 3-5.

9. Fatty acid analogue of the general formula (I):

Alkyl-X-CH_2 COOR

wherein Alkyl represents a saturated or unsaturated hydrocarbon group of from 8-22 carbon atoms, X represents a selenium atom and R is hydrogen of C_1 - C_4 alkyl.

10. Fatty acid analogue according to Claim 9 wherein the compound of general formula (I) is as defined in any of Claims 3-5.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 95/00195

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A61K 31/19
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	.STN International, File CA, Chemical Abstracts, volume 124, no. 9, 26 February 1996, (Columbus Ohio, US), Froeyland, Livar et al: "Tetradecylthioacetic acid incorporated into very low density lipoprotein: changes in the fatty acid composition and reduced plasma lipids in cholesterol-fed hamsters", abstract no. 115981, & J. Lipid Res. (1995), 36 (12), 2529-40 --	1-10
X	EP 0345038 A2 (NORSK HYDRO A.S.), 6 December 1989 (06.12.89) --	1,3-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 October 1996	17 -10- 1996
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Eva Johansson Telephone No: +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/10/96

International application No.
PCT/NO 95/00195

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A2- 0345038	06/12/89	SE-T3- 0345038	
		CA-A- 1329550	17/05/94
		DE-D,T- 68910386	09/06/94
		ES-T- 2059749	16/11/94
		US-A- 5093365	03/03/92